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Comparison between the empirical, machine and deep learning techniques to predict global solar irradiance for Mutale area in Limpopo Province, South Africa

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Abstract
The prediction of solar irradiance for certain regions is of utmost importance in guiding solar power conversion systems with a specific focus on design, modelling, and operation. In addition, the selection of proper regions with sufficient solar irradiance also plays a significant role for the decision-makers responsible for future investment policies about green energy. The lack of weather stations and measured solar parameter in most areas in the developing countries have contributed to the development of prediction models for solar irradiance. However, reliable prediction of solar irradiance is dependent on the availability of quality data and also the prediction methods used. Empirical models have been developed and used in the past; however, in recent times intelligent algorithms have proved to have more predictive power due to the availability of high-frequency data. Against this background, this study use two empirical models namely: the Clemence model and Hargreaves and Samani model to predict the global solar irradiance in Mutale station area in the Limpopo province in South Africa. Furthermore, machine learning and deep learning techniques namely: Support Vector Machines (SVM), Random Forest (RF) and Long-Short Term Memory (LSTM) networks were also used to predict global solar irradiance in the same area. To assess the efficiencies of these empirical and machine models, the estimated values for the global solar radiation was compared against the recorded data from the Mutale weather station

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Yes

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MSc

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